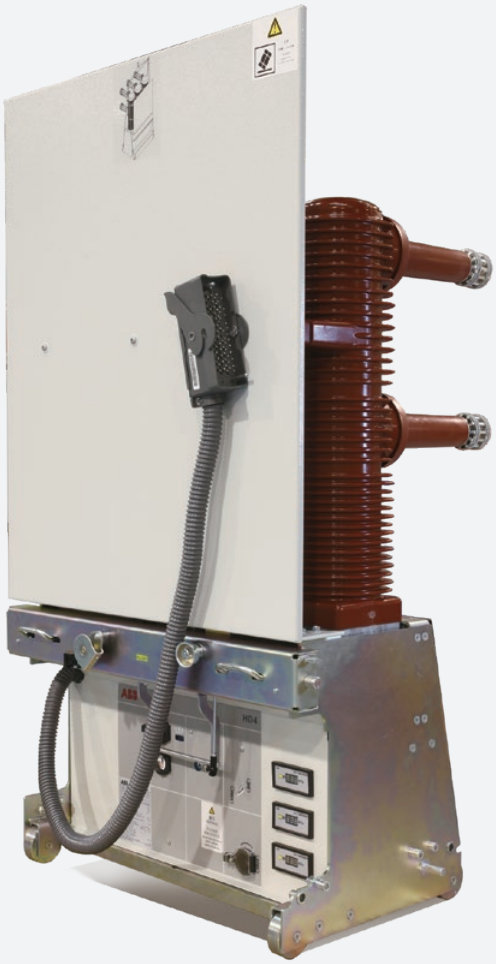
CATALOG

HD4

SF_6 insulated MV circuit breakers
40.5 kV, 1250...3150 A, 25...31.5 kA



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The HD4 medium voltage circuit breakers use SF_6 gas technology to protect your asset, ideal for all the application where a smooth switching is a plus. The HD4 are the great answer for the most fields of application like power distribution, protection of cables, overhead lines, transformers and substations.

Contents

HD4:
its strengths, your benefits

Safety and protection

Reliable in extreme conditions

Optimum interface

Productivity
Maximizing your output

- **Dedicated training for installation and maintenance**
  – Have your personnel trained to perform installation and maintenance
- **Specialized ABB Service personnel for installation and maintenance**
  – Count on ABB support for installation and maintenance

Easy to installing

- **Withdrawable version available**
  – Circuit breaker can be easily racked out and in for maintenance
  – You'll receive the complete circuit breaker ready to be installed in your panel

Speed up your projects

- **Circuit breaker + enclosure**
  – Opt for the advanced solution, circuit breaker + enclosure based on certified ABB design
- **Technical cooperation agreement**
  – Reduce your development time for new panel design

Efficiency
Optimizing your investments

Affordable range

- **Technical cooperation agreement**
  - Count on technical backup from ABB for developing new panels based on certified ABB design

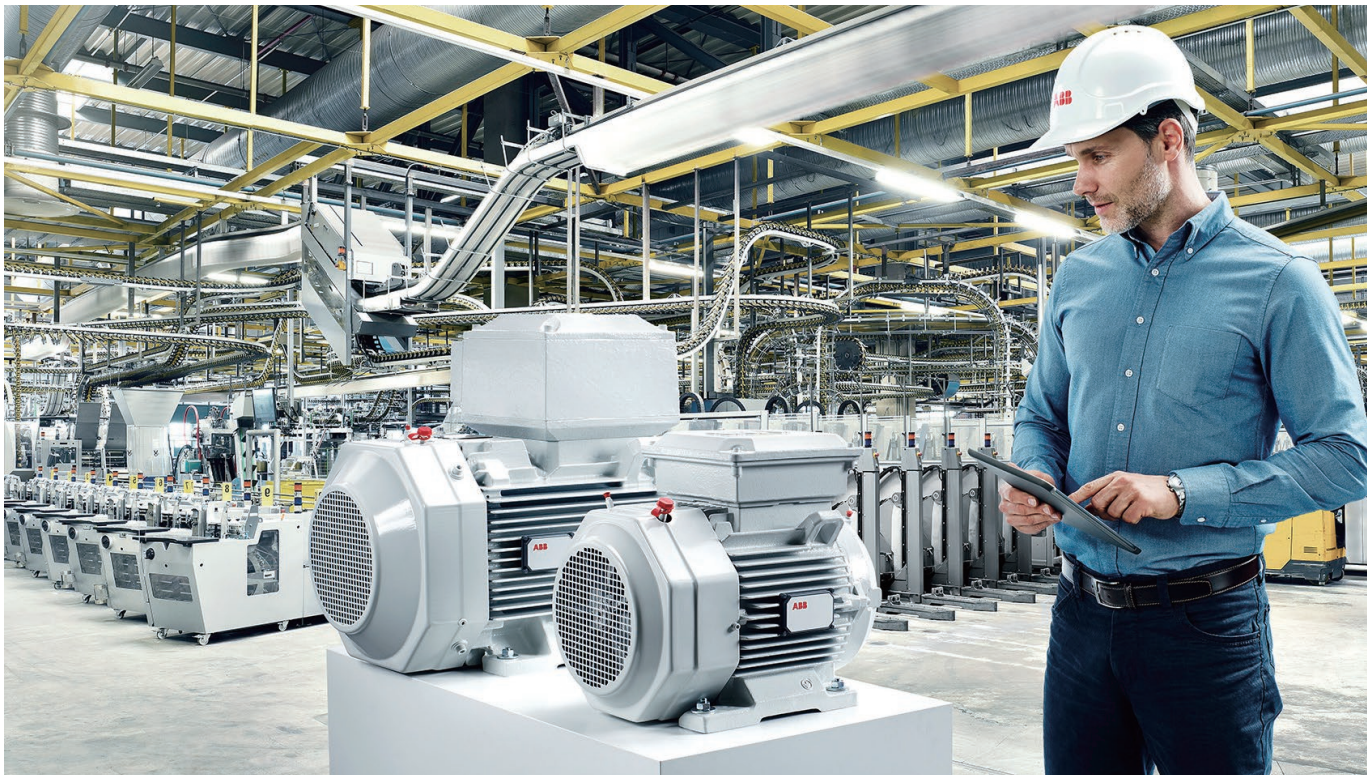
Continuity of service

- **Low maintenance**
  - High reliability and fewer downtimes since modular actuator ESH only contains a limited number of mechanical components

Reliability
Protecting your assets

Reliable in extreme conditions

- **Dielectric insulation guaranteed at 0 bar gauge pressure up**
  - Prevents the risk of dielectric faults and outage if the SF_6 pressure drops
- **Pressure switch for continuous monitoring of SF_6 pressure**
  - Check constantly to make sure that circuit breaker is able to protect the load from faults



Optimum interface

- **Standardized product family up to 40.5 kV and 3150 A**
  - Common, simple accessories and interface are available for the entire product family

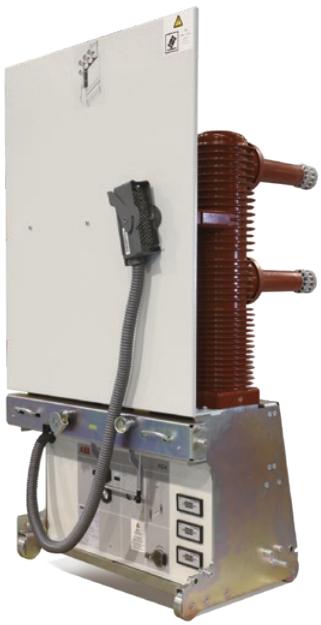
Safety and protection

- **SF_6-insulated auto-puffer technology without current chopping or overvoltage**
  - Extends the life of your equipment, especially when there are critical loads or outdated installations
  - Ideal for operating capacitor banks

Global availability

- **You can count on ABB**
  - Our global presence means you can rely on us for any type of support you may require

Description



General information

HD4 medium voltage circuit breakers use sulphur hexafluoride gas (SF_6) to extinguish the electric arc and as the insulating medium.

Breaking in SF_6 gas takes place without any arc chopping and without generation of overvoltages.

These characteristics ensure long electrical life of the circuit breaker and limited dynamic, dielectric and thermal stresses on the installation.

The circuit breaker poles, which make up the breaking part, are systems with lifelong sealed pressure (IEC 62271-100 Standards) and are maintenance-free.

The ESH type mechanical operating mechanism, with stored energy has free release and allows opening and closing operations independently of the operator's actions.

The operating mechanism and the poles are fixed to the metal structure which also acts as a support for the kinetics for operating the moving contacts. Circuit breakers in the withdrawable version are fitted with a truck to allow racking in and racking out of the switchgear or enclosure.

The light and compact structure of the circuit breaker ensures great sturdiness and excellent mechanical reliability.

Available versions

HD4 circuit breakers are available in the fixed and withdrawable version with front operating mechanism. The withdrawable version is available for PowerBlock modules and UniGear type ZS3.2 switchgears.

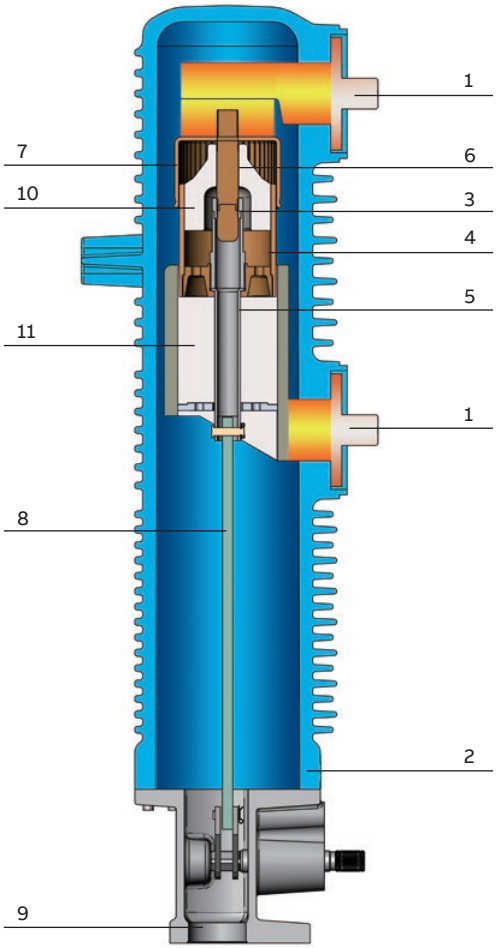
Fields of application

HD4 circuit breakers are used in power distribution to control and protect lines, transformer and distribution substations, motors, transformers, capacitor banks, etc. Thanks to the SF_6 autopuffer breaking technique, the HD4 circuit breakers do not generate operating overvoltages, and are therefore also highly suitable for retrofitting, upgrading and enlarging older installations where the motor, cable, etc. insulating materials may be particularly sensitive to dielectric stresses.

Breaking technique

The breaking technique of HD4 circuit breakers is based on compression and self-blast techniques to obtain top performances at all service current values, with minimum arc times, gradual arc extinction without chopping, and no restriking or operating overvoltages.

The HD4 series brings to medium voltage the advantages of the “autopuffer” breaking technique already used in high voltage.



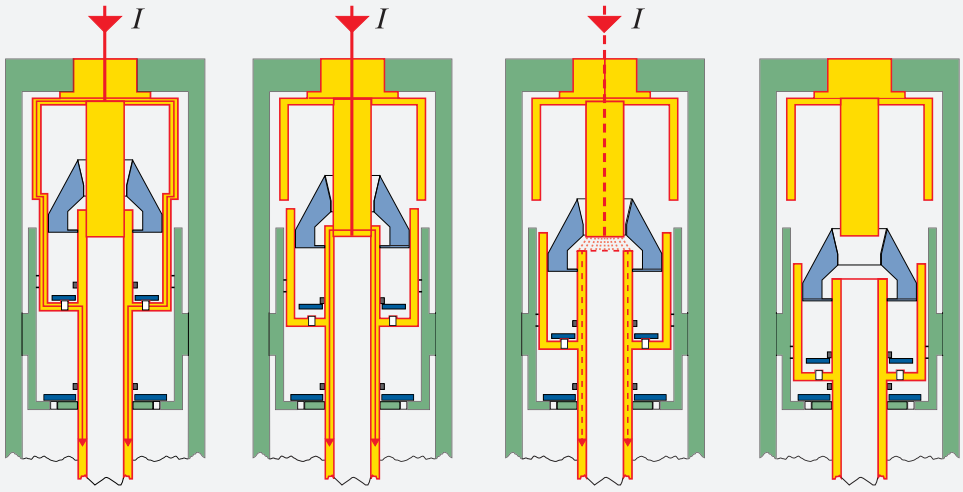
1 Terminal
2 Insulating case
3 Blasting nozzle
4 Moving contact
5 Moving arcing contact
6 Fixed arcing contact
7 Fixed contact
8 Insulating tie-rod
9 Anti-explosion valve
10 Upper chamber
11 Lower chamber

Standards and approvals

HD4 circuit breakers comply with IEC 62271-100 and GB/T 1984 Standards. Additionally, HD4 breakers are registered in the main naval registers and are therefore suitable for Marine applications. They have undergone the following tests and guarantee safety and reliability of the apparatus in service in all installations.

- Type tests: heating, withstand insulation at industrial and impulse frequency, short-time and peak withstand current, mechanical duration, making and breaking of short-circuit currents;
- Individual tests: insulation with voltage at industrial frequency in the main circuits and insulation of the auxiliary and control circuits, measurement of the main circuit resistance, mechanical and electrical operation.

The HD4 circuit breakers are tested according to the requirements of the GB/T 1984 and the IEC 62271-100 Standard (classes E2, M2, C2).



Circuit breaker closed | **Main contact separation** | **Arcing contact separation** | **Circuit breaker open**

Main contact separation

No electric arc strikes as the current flows through the arcing contacts.During its run downwards, the moving part compresses the gas contained in the lower chamber. The compressed gas flows out of the lower chamber into the upper chamber, taking them both to the same pressure.

Arcing contact separation

The current flows thanks to the electric arc which has struck between the arcing contacts. The gas cannot get out through the nozzle because the hole is still closed by the fixed arcing contact and cannot get out through the inside of the moving arcing contact either because the electric arc closes this (clogging effect).

- **with low currents,** when the current passes through natural zero and the arc is quenched, the gas flows through the contacts. The low pressure reached cannot chop the current and the modest amount of compressed gas is sufficient to restore dielectric resistance between the two contacts, preventing restriking on the rising front of the return voltage.
- **with high short-circuit currents,** the pressure wave generated by the electric arc closes the valve between the two chambers so that the circuit breaker starts to operate as a “pure self-blast”. The pressure increases in the upper volume thanks to heating of the gas and molecular disassociation due to the high temperature. The increase in pressure generated is proportional to the arc current and ensures quenching on first passage through current zero.

Circuit breaker open

The arc has been interrupted, the selfgenerated pressure in the upper volume is reduced because the gas is flowing through the contacts. The valve re-opens and so a new flow of fresh gas comes into the breaking chamber. The apparatus is therefore immediately ready to close and trip again up to its maximum breaking capacity

Safety

Safe distribution switchgear can be constructed with HD4 circuit breakers thanks to the full range of mechanical and electrical locks (available on request).

The locks have been designed to prevent incorrect operations and to allow the installations to be inspected while guaranteeing maximum operator safety.

Key locks enable opening and closing and/or racking-in and racking-out operations.

The closed door racking-out device only allows the circuit breaker to be racked in and out of the switchgear when the door is closed.

Anti-racking-in locks prevent circuit breakers with different rated currents from being racked-in and racked-out when the circuit breaker is closed.

ESH operating mechanism

- Just one device for the whole series.
- The same set of accessories for all the types of
- HD4 circuit breaker.
- Fixed strikers to facilitate assembly or
- Replacement of accessories.
- Accessory cabling with socket and plug.

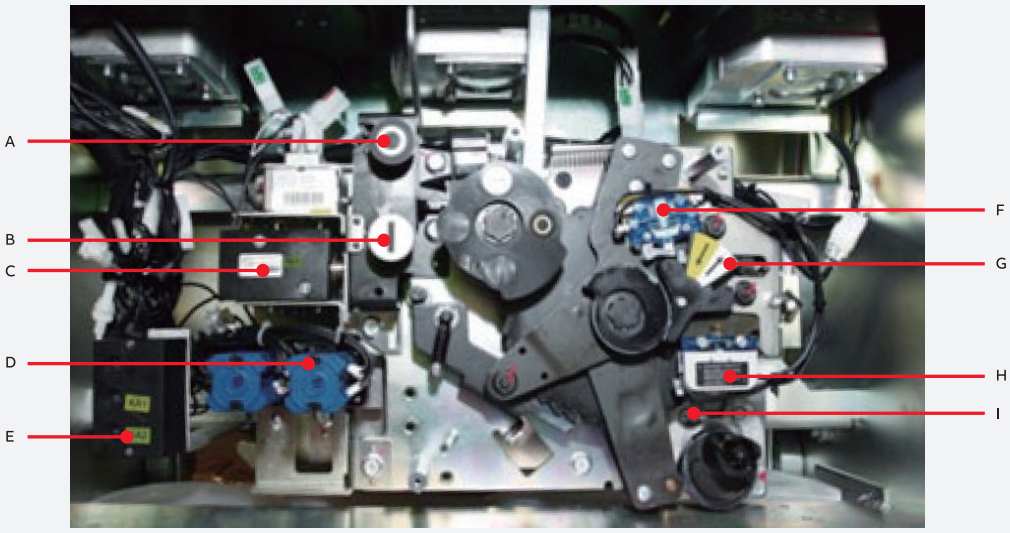
This is a stored energy mechanical actuator with manual and/or motor-operated loading of the closing spring; the opening spring is loaded by the same actuator during the closing operation. The opening and closing operations take place at speeds that are independent from the operator and the operating mode (manually using local or remote push-buttons or by means of the opening and closing shunt releases). When it is not equipped with a geared motor for loading the closing springs, the operating mechanism can enable the following sequences:

- With c.-breaker open and closing spring loaded: C - O
- With c.-breaker closed and closing spring loaded: O - C - O.

When equipped with a geared motor for loading the closing springs, the operating mechanism can perform repeated re-closing operations thanks to automatic reloading after each closing operation.

- Highly reliable operating mechanisms thanks to a low number of components which are manufactured using production systems for large quantities
- Accessories common to the entire range
- Electrical accessories that can be easily and-quickly installed or replaced thanks to wiring preengineered with plug-socket connectors
- Mechanical anti-pumping device is supplied as-standard

Circuit breaker operating mechanism



A Opening pushbutton
B Closing pushbutton
C Operating mechanism locking electromagnet
D Open/closed auxiliary contacts
E Gas monitoring device with led
F Contacts for signalling spring charged/discharged
G Signalling device for closing springs charged/discharged
H Closing spring loading motor limit switch
I Geared motor for closing spring charging

Technical documentation

PTo obtain in-depth knowledge of technical and application aspects of the HD4 circuit breakers please ask for the following publications:

- Powerbloc BA441/03E Modules
- Unigear ZS3.2 1YHA000023 Switchgear

Quality System

Complies with UNI EN ISO 9001 Standards, certified by an independent organisation.


DNV·GL

MANAGEMENT SYSTEM CERTIFICATE

This is to certify that the management system of

ABB Xiamen Switchgear Co., Ltd.

No.885, 829 and 833, FangShanXiEr Road, Xiang'An Industrial Area, Torch Hi-Tech Industrial Development Zone, Xiamen, Fujian, China

has been found to conform to the Quality Management System standard:
ISO 9001:2015/GB/T 19001-2016

This certificate is valid for the following scope:

Design, Manufacture and Service of Medium Voltage (1kV-52kV) Switchgear and Related Apparatus


TÜVRheinland

Certificate of Appointment

No. UA 50431084-0001

The Applicant

**ABB Xiamen Testing Laboratories
ABB Industrial Center, No.885,
FangShanXiEr Road, Xiang'an District,
Xiamen
P. R. China**

has been authorized to carry out testing by the order and under supervision of TÜV Rheinland according to

Parts of IEC 62271-1:2017;
IEC 62271-100:2008+A1:2012+A2:2017;
IEC 62271-102:2018; IEC 62271-106:2011;
IEC 62271-200:2011

An audit of the laboratory was conducted according to ISO/IEC 17025 by a TÜV Rheinland auditor.
Audit Report No. 50230409-001
This certificate is valid until the next scheduled audit or up to 18 months (expired), at the discretion of TÜV Rheinland.

Date of issue: 12.03.2019

Certification Body

Zhao Xinhua

Quality System

Complies with ISO 9001 Standards, certified by an independent organisation.

Test Laboratory

Complies with UNI CEI EN ISO/IEC 17025 Standards, accredited by an independent organisation.


DNV·GL

MANAGEMENT SYSTEM CERTIFICATE

This is to certify that the management system of

ABB Xiamen Switchgear Co., Ltd.

No.885, 829 and 833, FangShanXiEr Road, Xiang'An Industrial Area, Torch Hi-Tech Industrial Development Zone, Xiamen, Fujian, China

has been found to conform to the Environmental Management System standard:
ISO 14001:2015

This certificate is valid for the following scope:

Design, Manufacture and Service of Medium Voltage (1kV-52kV) Switchgear and Related Apparatus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MANAGEMENT SYSTEM CERTIFICATE

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ABB Xiamen Switchgear Co., Ltd.

No.885, 829 and 833, FangShanXiEr Road, Xiang'An Industrial Area, Torch Hi-Tech Industrial Development Zone, Xiamen, Fujian, China

has been found to conform to the Occupational Health and Safety Management System standard:
ISO 45001:2018

This certificate is valid for the following scope:

Design, Manufacture and Service of Medium Voltage (1kV-52kV) Switchgear and Related Apparatus

Environmental Management System

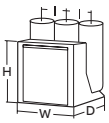
Complies with ISO 14001 Standards, certified by an independent organisation.

Health and Safety Management System

Complies with ISO 45001 Standards, certified by an independent organisation.

Selection and ordering

General characteristics of withdrawable circuit breakers for UniGear type ZS3.2 switchgear or OEM similar panel.

Circuit breaker	**HD4/Z 40.5**					
Standards	IEC 62271-100		GB/T 1984			
Rated voltage	Ur [kV]	40.5				
Rated insulation voltage	Us [kV]	40.5				
Withstandvoltage at 50 Hz	Ud (1 min) [kV]	95 (1)				
Impulse withstand voltage	Up [kV]	185 (1)				
Rated frequency	fr [Hz]	50-60				
Rated normal current (40 °C) (1)	Ir [A]	1250	1600	2000	2500	3150 (2)
Rated breaking capacity	Isc [kA]	25	25	25	25	25
		31.5	31.5	31.5	31.5	31.5
Rated short-time withstand current (4s)	Ik [kA]	25	25	25	25	25
		31.5	31.5	31.5	31.5	31.5
Making capacity	Ip [kA]	63	63	63	63	63
		80	80	80	80	80
Operation sequence	[O-0.3s-CO-15s-CO]					
Opening time	[ms]	35-65				
Arcing time	[ms]	10-15				
Total breaking time	[ms]	40-80				
Closing time	[ms]	60-100				
Overall dimensions 	H [mm]	1575				
	W [mm]	850				
	D [mm]	175				
	Pole centre distance I [mm]	280				
Standardised table of dimensions		TN 7227				
Absolute SF_6 gas pressure (3)	[kPa]	550				
Operating temperature (4)	[°C]	-5...40				
Weight	[kg]	280	280	350	350	350

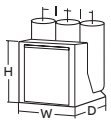
(1) Withstand voltage and Impulse withstand voltage at across the open switching: 118/215 kV

(2) With forced ventilation

(3) Rated service value; warning pressure: 480 KPa (Absolute); Insufficient gas pressure: 450 KPa (Absolute).

(4) Operating temperature need -25°C, Consulting the manufacturer.

General characteristics of fixed circuit breakers

Circuit breaker	**HD4**					
Standards	IEC 62271-100		GB/T 1984			
Rated voltage	Ur [kV]	40.5				
Rated insulation voltage	Us [kV]	40.5				
Withstandvoltage at 50 Hz	Ud (1 min) [kV]	95 (1)				
Impulse withstand voltage	Up [kV]	185 (1)				
Rated frequency	fr [Hz]	50-60				
Rated normal current (40 °C) (1)	Ir [A]	1250	1600	2000	2500	3150 (2)
Rated breaking capacity	Isc [kA]	25	25	25	25	25
		31.5	31.5	31.5	31.5	31.5
Rated short-time withstand current (4s)	Ik [kA]	25	25	25	25	25
		31.5	31.5	31.5	31.5	31.5
Making capacity	Ip [kA]	63	63	63	63	63
		80	80	80	80	80
Operation sequence	[O-0.3s-CO-15s-CO]					
Opening time	[ms]	35-65				
Arcing time	[ms]	10-15				
Total breaking time	[ms]	40-80				
Closing time	[ms]	60-100				
Overall dimensions 	H [mm]	1314				
	W [mm]	1010				
	D [mm]	653				
	Pole centre distance I [mm]	360				
Standardised table of dimensions		TN 7227				
Absolute SF_6 gas pressure (3)	[kPa]	550				
Operating temperature (4)	[°C]	-5...40				
Weight	[kg]	270	270	300	310	310

(1) Withstand voltage and Impulse withstand voltage at across the open switching: 118/215 kV

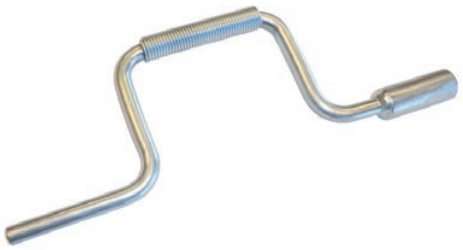
(2) With forced ventilation

(3) Rated service value; warning pressure: 480 KPa (Absolute); Insufficient gas pressure: 450 KPa (Absolute).

(4) Operating temperature need -25°C, Consulting the manufacturer.

Optional accessories

The accessories identified with the same number are alternative to each other; consult the table at the end of the chapter for the electrical characteristics.



Circuit breaker racking-out/racking-in lever.

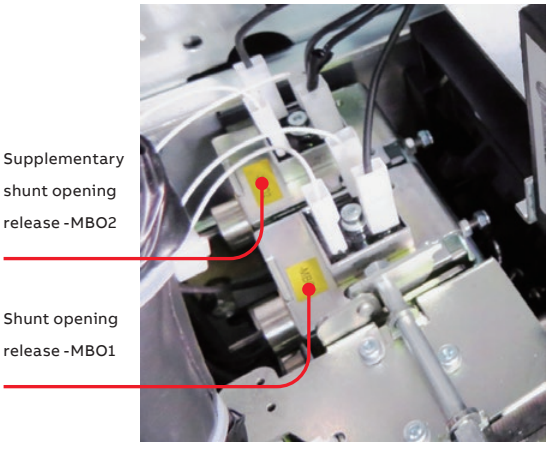
Manual charging lever of operating mechanism springs.

1 Shunt opening release

1A Shunt opening release -MBO1
Allows the opening command of the apparatus to be enabled by remote control.

This release is only suitable for instantaneous service; there is always an auxiliary contact -BGB1 to de-energize it after the circuit breaker has opened. To guarantee the release action, the current impulse must last at least 100 ms. The coil of this release can be controlled by any CCC (Control Coil Continuity) device and TCS (Trip Circuit Supervision) circuit opening supervision device.

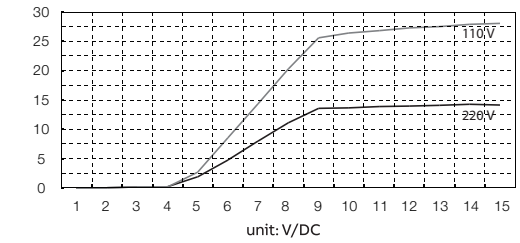
1B Additional shunt opening release -MBO2
Similarly to shunt opening release -MBO1, this allows the opening command of the apparatus to be transmitted by remote control. It can be energized by the same circuit as main shunt opening release -MBO1 or by a circuit that is completely separate from release -MB01. This release is only suitable for instantaneous service. There is always an auxiliary contact -BGB1 to deenergize it after the circuit breaker has opened. To guarantee the release action, the current impulse must last at least 100 ms. The coil of this release can be controlled by any CCC (Control Coil Continuity) device and TCS (Trip Circuit Supervision) circuit opening supervision device.



Characteristics	
Un (DC)	24, 30, 48, 60, 110-132, 220-250 V
Un (AC, 50 Hz)	110-127, 220-240 V
Operating voltage range	65%...110%Un (DC)
	85%...110%Un (DC)
Ps	125 W/VA
Duration of inrush	~45 ms
Pc	5 W/VA
Test voltage	2000 V 50 Hz (1 min)

- Releases with rated voltage of 110-220 V AC/DC can be monitoring without STU device. Volt-ampere characteristic curve for 110 V-220 V AC/DC is shown below:

Volt-ampere characteristic curve of opening and closing release
unit: mA



110 V
220 V

For release of 110 V supply voltage, monitoring current should be less than 20 mA. The total resistance of other components in the monitoring circuit, excluding the release, should not be less than 5.5 kΩ.

For release of 220 V supply voltage, monitoring current should be less than 10 mA. The total resistance of other components in the monitoring circuit, excluding the release, should not be less than 20 kΩ.

- For releases with rated voltage range from 24 V to 60 VAC/DC, the only device capable to carry out monitoring of the functions is the STU device. Please consult manufacturer for more information.

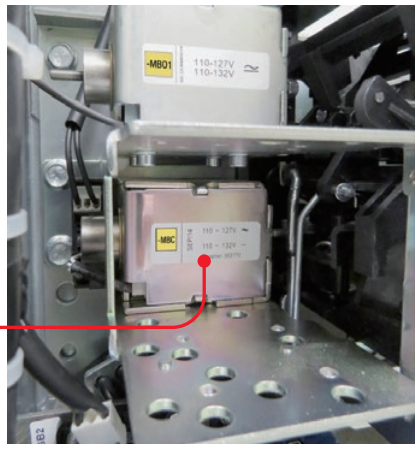
2 Shunt closing release -MBC

Allows the closing command of the apparatus to be transmitted by remote control.

To guarantee the closing action, the current impulse must last at least 100 ms. This release is suitable for both instantaneous and permanent duty (an auxiliary contact that de-energizes it after the circuit breaker has closed is not envisaged).

Permanently energized, the release provides the electrical anti-pumping function when both the opening and closing remote commands (electrical) are maintained. If shunt closing release -MBC and undervoltage release -MBU are energized by the same supply voltage and automatic closing of the circuit breaker is required when the auxiliary voltage returns, there must be a delay of at least 50 ms between undervoltage release energizing and energizing of the shunt closing release to allow the closing operation to take place.

Shunt closing release -MBC



Characteristics	
Un (DC)	24, 30, 48, 60, 110-132, 220-250 V
Un (AC, 50 Hz)	110-127, 220-240 V
Operating voltage range	85%...110%Un (DC)
Ps	250 W/VA
Duration of inrush	~150 ms
Pc	5 W/VA
Test voltage	2000 V 50 Hz (1 min)

3 Under-voltage release -MBU

Undervoltage release -MBU opens the circuit breaker when there is a sensible reduction or lack of the voltage that energizes it. The circuit breaker can only close when the release is energized (the closing lock is obtained mechanically). It can be used for remote release (by means of a pushbutton of the normally closed type), for locking on automatic closing and/or opening in the absence of voltage in the auxiliary circuits. Energized by means of the secondary output of a voltage transformer, it provides locking upon automatic closing/opening in the absence of voltage in the Medium Voltage main circuit. If shunt closing release -MBC and undervoltage release -MBU are energized by the same supply voltage and automatic closing of the circuit breaker is required when the auxiliary voltage returns, there must be a delay of at least 50 ms between undervoltage release energizing and energizing of the shunt closing release to allow the closing operation to take place.

3A Undervoltage release -MBU (only for power supply branched on the supply side of the circuit breaker)

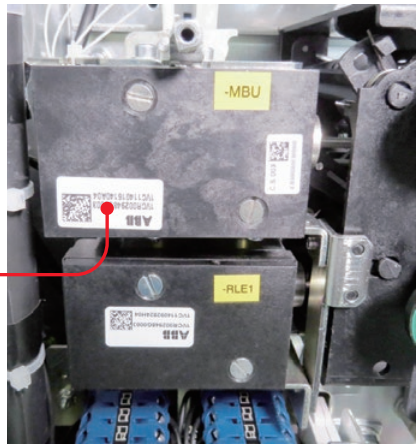
3B Undervoltage release -MBU with electronic time-lag device -KFT (only for power supply branched on the supply side of the circuit breaker)

Circuit breaker closing is inhibited when the undervoltage release (equipped with electronic time-lag device -KFT) is not energized. Electronic time-lag device -KFT is only designed to delay the tripping action of undervoltage release –MBU at preset, adjustable times (0.5 - 1 - 1.5 - 2 - 3 s).

This device is consigned with the 0.5 s time setting.

To avoid tripping, use of the delayed undervoltage release is convenient when the supply network of release -MBU may often be liable to brief voltage dips or tiny power outages. The voltage of the undervoltage release must be within the operating range of the electronic time-lag device.

Under-voltage release -MBU



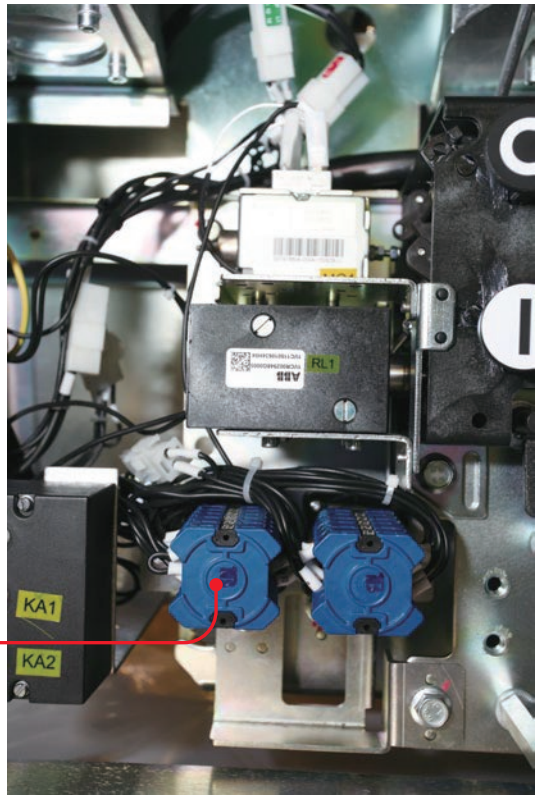
Characteristics		
Un (DC)	24, 30, 48, 60, 110-132, 220-250 V	
Un (AC, 50 Hz)	110-127, 220-240 V	
Operating voltage range	≤35%Un	Prevent CB from closing
	35-65%Un	Opening CB
	85%...110%Un	CB can operate normally
Ps	250 W/VA	
Duration of inrush	~150 ms	
Pc	5 W/VA	
Test voltage	2000 V 50 Hz (1 min)	

4 Auxiliary and signalling contacts
Auxiliary contacts –BGB1, -BGB2

Electrical signalling of circuit breaker open/closed can be obtained with a set of 12 auxiliary contacts (6NO+6NC) for the withdrawingable version and 16 auxiliary contacts(8NO+8NC) for the fixed version.

Auxiliary contacts –BGB1 and –BGB2 conform to the following standards/regulations/directives:

- IEC 62271-100
- IEEE C37.54
- EN 61373 cat.1 class B / impact and vibration test
- Germanish Loyd regulation / vibrations envisaged by the shipping registers
- UL 508
- EN 60947 (DC-21A DC-22A DC-23A AC-21A)
- RoHS Directive



4

General characteristics	
Insulation voltage to standard VDE 0110, Group C	500 V AC
	200 V DC
Rated voltage	24 V ... 250 V
Test voltage	2 kV for 1 min 50 HZ
Maximum rated current	10 A - 50/60 Hz
Breaking capacity	Class 1 (IEC 62271-1)
Number of contacts	5
Groups of contacts	10 / 12 / 16
Contact travel	90°
Actuating force	0.66 Nm
Resistance	<6.5 mΩ
Storage temperature	–30 °C ... +120 °C
Operating temperature	–20 °C ... +70 °C (-30° ref. ANSI 37.09)
Contact overtemperature	10 K
Mechanical life	10,000 mechanical operations
Protection class	IP20
Cable section	1 mm^2

Electrical characteristics (according to IEC 60947)		
Rated current Un		Breaking capacity (10000 interruptions)
220 V AC	Cosϕ = 0.70	20 A
	Cosϕ = 0.45	10 A
24 V DC	1 ms	12 A
	15 ms	9 A
	50 ms	6 A
60 V DC	1 ms	10 A
	15 ms	6 A
	50 ms	4.6 A
110 V DC	1 ms	7 A
	15 ms	4.5 A
	50 ms	3.5 A
220 V DC	1 ms	2 A
	15 ms	1.7 A
	50 ms	1.5 A
250 V DC	1 ms	2 A
	15 ms	1.4 A
	50 ms	1.2 A

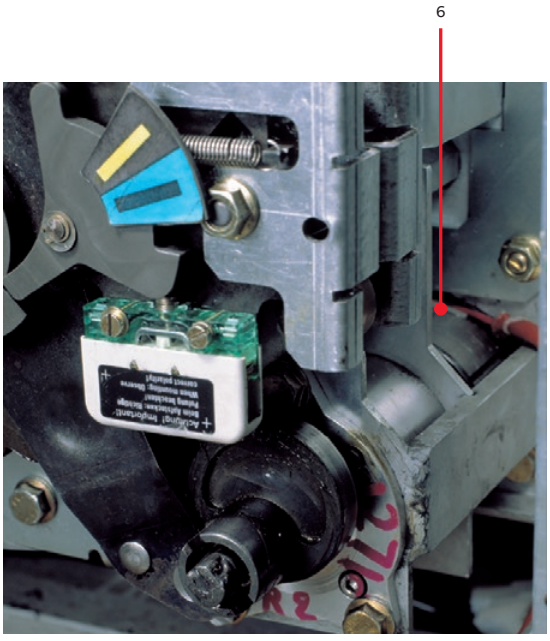
5 Electrical signalling contacts for circuit breaker connected and isolated (-BGT1; -BGT2)

Contacts -BGT1, -BGT2 are supplied as standard equipment when locking magnet -RLE1 is installed in the operating mechanism. Contacts -BGT1 and BGT2 have only for the withdrawing-able version.

6 Spring-loading geared motor -MAS

The geared motor automatically loads the closing spring of the circuit breaker's operating mechanism after the circuit breaker has closed each time and until the yellow "spring loaded" indicator appears. If a power cut occurs when loading is in progress, the geared motor stops and automatically starts loading the springs again when the power returns. Loading can always be completed in the manual mode (as it is during maintenance work) by means of the dedicated lever supplied. Check the power available in the supply circuit to find out whether several motors for loading the closing springs can operate at the same time. To prevent excessive power consumption, especially when the installation is put into service, it is advisable to load the springs by hand before energizing the auxiliary circuits.

Characteristics	
Un (DC)	24, 30, 48, 60, 110-132, 220-250 V
Un (AC, 50 Hz)	110-127, 220-240 V
Operating voltage range	85%...110%Un
Ps	1500 W/VA
Duration of inrush	~100 ms
Pc	200 W/VA
Test voltage	2000 V 50 Hz (1 min)
Charging Time	≤8 s



7 Signalling for closing spring loaded/ discharged

Contact for signalling closing spring loaded/ discharged -BGS2.

This consists of a microswitch, which allows remote signalling of the state of the closing spring of the circuit breaker operating mechanism.

One of the following signals can be selected:

7A contact open: electrical signalling of spring loaded

7B contact closed: spring discharged signal

8 Gas monitoring device

Notes:

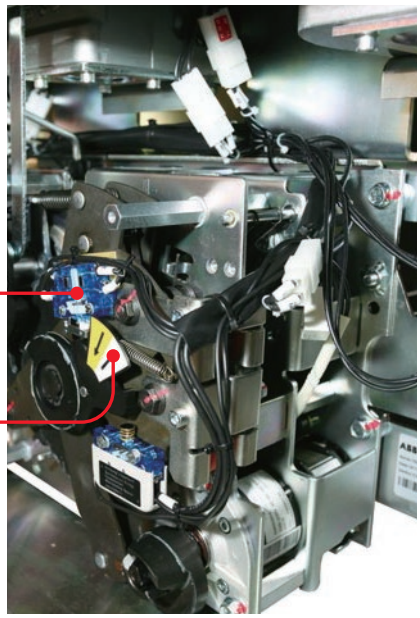
- Specify when ordering the apparatus if the pressure switch is required since it cannot be installed by the customer at a later date
- It is composed of two pressure switches or density switches (-BP1, -BP2, -BP3) installed on the pole and intermediate relays (-KA1, -kA2).
- When the gas pressure reachs a value of less than 480 kPa absolute, provide alarm signal; when the gas pressure reachs a value of less than 450 kPa absolute, the SF_6 gas control device locks the circuit breaker.

Characteristic parameters of intermediate relay are as follows:

Characteristics	
Un (DC)	24, 30, 48, 60, 110-132, 220-250 V
Un (AC, 50 Hz)	110-127, 220-240 V

Electrical signalling of spring loaded/discharged

Spring loaded/discharged mechanical indicator



Intermediate relays (-KFA1, -KFA2)

9 Locking magnet -RLE1 on operating mechanism

Local manual closing and remote electrical closing can only be obtained when electromagnet RLE1 is energized. When -RLE1 is requested for a withdrawable circuit breaker, it comes with contact -BGT2 unless contacts -BGT1, -BGT2 have been requested.

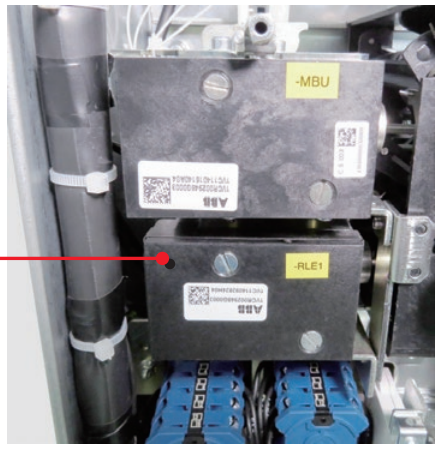
Characteristics	
Un (DC)	24, 30, 48, 60, 110-132, 220-250 V
Un (AC)	110-127, 220-240 V
Operating voltage range	80%...110%Un (DC)
Ps	250 W/VA
Duration of inrush	~150 ms
Pc	5 W/VA
Test voltage	2000 V 50 Hz (1 min)

10 Locking magnet -RLE2 on truck

The withdrawable circuit breaker can be racking-out/racking-in only after the locking magnet RL2 on truck is energized.

Characteristics	
Un (DC)	24, 30, 48, 60, 110-132, 220-250 V
Un (AC)	110-127, 220-240 V
Operating voltage range	80%...110%Un (DC)
Ps	250 W/VA
Duration of inrush	~150 ms
Pc	5 W/VA
Test voltage	2000 V 50 Hz (1 min)

Locking magnet on operating mechanism



11 Gas pressure digital display meter (-PGD)

- can be displayed intuitively and in real time;
- Local man-machine interface (LHMI) mounted on the low-voltage compartment is also optional, which is more convenient to observe SF_6 gas state.

Characteristics	
Display range	0~999 kPa (Absolute)
Accuracy of measurement	1.5%@20 °C, 2.5%@-30 °C
Protection grade	IP5X
Communication interface	RS-485 (1PC)
Communication protocol	Modbus RTU, Baud rate 9600 bps

LHMI on the low-voatage compartment	
Rated voltage	24 V DC
Communication interface	RS-485
Hole size	154x94 mm

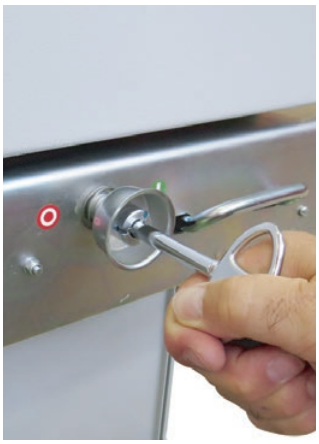
12 Door locking device (optional)

The locking device is used to prevent the circuit breaker rank in when the panel door is open. This locking device only on the panel doors be fit-ted accordingly can be used.

13 3-lobed key for manual opening and closing operations

Manual operation of the circuit-breaker, by turning the triple bit key approx. 15 clockwise (ON), or approx. 15 anti-clockwise (OFF).

Triple bit key (ON-OFF operation)



Specific product characteristics

Normal service conditions

- Maximum site altitude: 1000 m above sea level
- Ambient temperature: -5℃~+40℃
- Humidity:
  - Highest mean value of relative humidity measured over 24 hours 95%
  - Highest mean value of vapour pressure measured over 24 hours 2.2 kPa
  - Highest mean value of relative humidity measured over 1 month 90%
  - Highest mean value of vapour pressure measured over 1 month 1.8 kPa

* For practical applications beyond this condition, please contact us.

Tropicalization

HD4 circuit breakers are manufactured in compliance with the strictest regulations for use in hot-humid-saline climates. All the most important metal components are treated against corrosive factors according to atmospheric corrosivity class C of standard UNI 9223.

Galvanisation is carried out in accordance with GB/T 9799 Standards, classification code Fe/Zn 12, with a thickness of 12x10-6 m, protected by a conversion layer mainly consisting of chromates in compliance with the GB/T 9800 Standards.

Resistance to vibrations

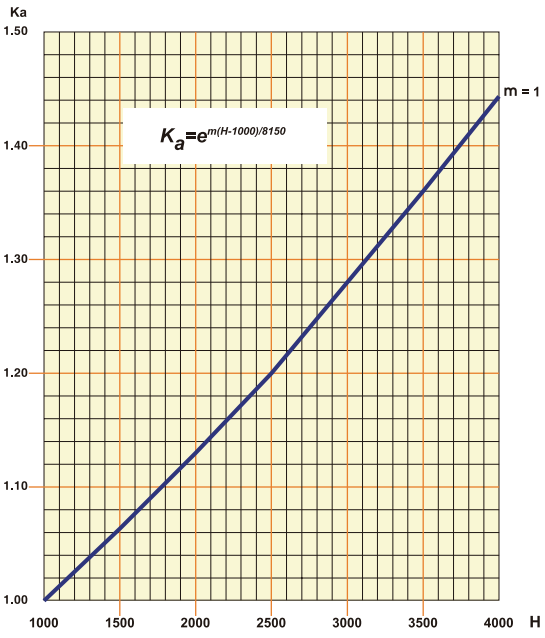
HD4 circuit breakers are unaffected by mechanically generated vibrations. For the versions approved by the naval registers, please contact us.

Altitude

The insulating property of air decreases as the altitude increases, therefore this must always be taken into account for external insulation of the apparatus (the internal insulation does not undergo any variations as it is guaranteed by the SF_6 gas).

The phenomenon must always be taken into consideration during the design stage of the insulating components of apparatus to be installed over 1000 m above sea level In this case a correction coefficient must be considered, which can be taken from the graph to the side, built up on the basis of the indications in the IEC 62271-1 and GB/T 11022 Standards.

The following example is a clear interpretation of the indications given above.



Ka = $e^{m\,(H-1000)/8150}$ with m=1

H = altitude in metres

m = value referred to industrial frequency and the atmospheric impulse withstand voltages and those between phase and phase. Defined value for m = 1

Graph for determining the Ka correction factor according to the altitude, Example:

- Installation altitude: 2000 m
- Service at a rated voltage of 35 kV
- Withstand voltage at power frequency 95 kV rms
- Impulse withstand voltage 185 kVp
- Ka Factor = 1.13 (see graph)

Taking the above parameters into consideration, the apparatus will have to withstand the following values (under test at zero altitude i.e. at sea level):

- Withstand voltage at power frequency equal to: 95 x 1.13 = 107.35 kVrms
- Impulse withstand voltage equal to: 185 x 1.13 = 209.05 kVp.

From the above calculation results indicate that the circuit breaker used at high altitude must be able to withstand higher insulation levels at zero altitude. Contact manufacturer for type selection of circuit breaker with body.

Environmental protection programme

HD4 circuit breakers are manufactured in accordance with the ISO 14000 Standards (Guidelines for environmental management). The production processes are carried out in compliance with the Standards for environmental protection in terms of reduction in energy consumption as well as in raw materials and production of waste materials. All this is thanks to the medium voltage apparatus manufacturing facility environmental management system. Assessment of the environmental impact of the life cycle of the product, obtained by minimising energy consumption and overall raw materials of the product, became a concrete matter during the design stage by means of targeted selection of the materials, processes and packing. This is to allow maximum recycling at the end of the useful life cycle of the apparatus.

Anti-pumping device

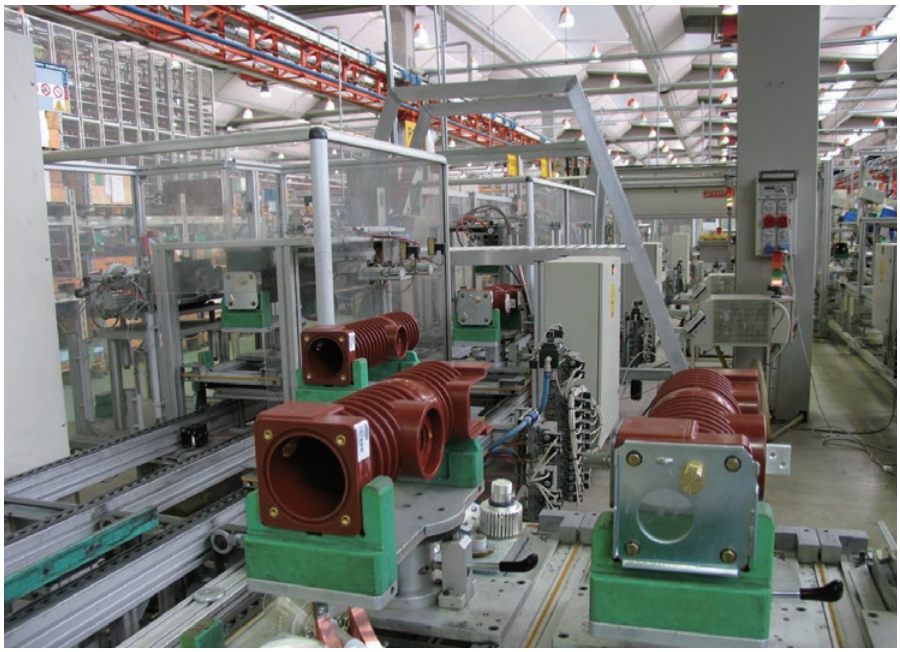
The ESH operating mechanism on HD4 circuit breakers (in all versions) is fitted with a mechanical anti-pumping device which prevents re-closing due to either electrical or mechanical commands.

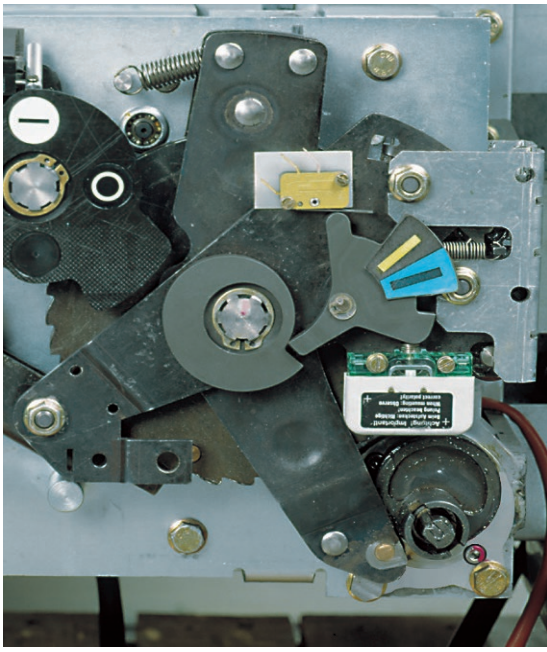
Should both the closing command and any one of the opening commands be active at the same time, there would be a continuous succession of opening and closing operations.

The anti-pumping device avoids this situation, ensuring that each closing operation is only followed by a single opening operation and that there is no closing operation after this. To obtain a further closing operation, the closing command must be released and then relaunched.

Furthermore, the anti-pumping device only allows circuit breaker closure if the following conditions are present at the same time:

- Operating mechanism springs fully charged
- Opening pushbutton and/or opening release (-MBO1/-MBO2) not enabled
- Main circuit breaker contacts open.



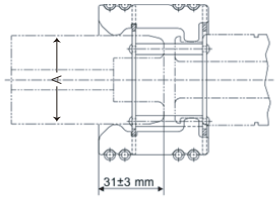


Overall dimensions

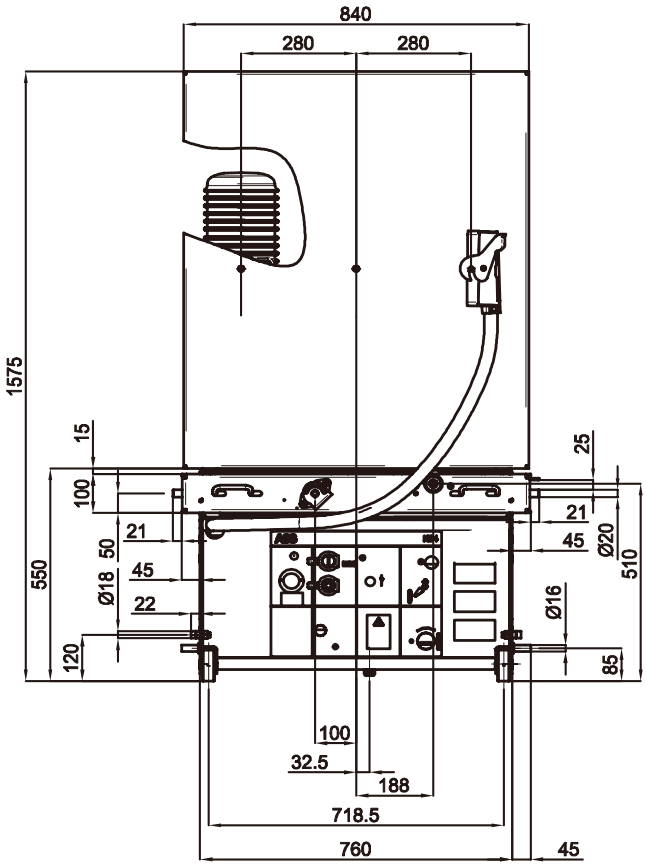
HD4/Z withdrawable circuit breakers

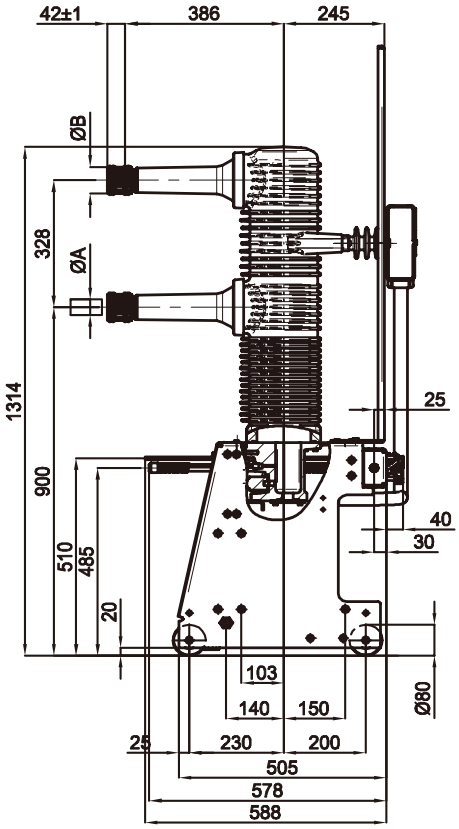
	1.0 Ir (Standard)		1.1 Ir (specific requirement)	
	TN: 1VCD000223		TN: 1VCD000224	
Ir	A	B	A	B
1250 A	Φ35 mm	Φ76 mm	Φ35 mm	Φ76 mm
1600 A	Φ35 mm	Φ76 mm	Φ49 mm	Φ90 mm
2000 A	Φ79 mm	Φ120 mm	Φ79 mm	Φ120 mm
2500 A	Φ79 mm	Φ120 mm	Φ109 mm	Φ158 mm
3000 A*	Φ79 mm	Φ120 mm		

(*) with forced ventilation in switchgear type



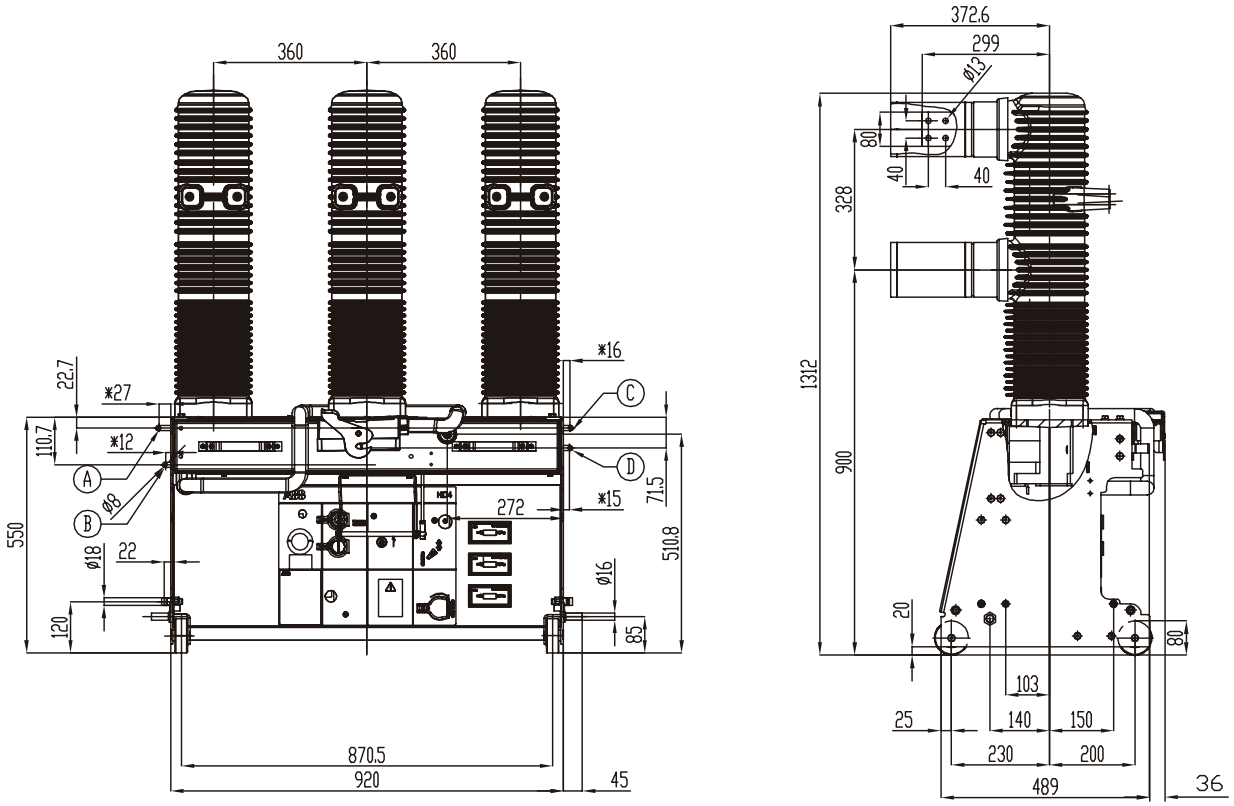
Insert dimension of contact





HD4 fixed circuit breakers

TN	Ir	Recommended connecting bus (not less than)
1YHT310004R0101	1250 A	10×100
	1600 A	10×100
	2000 A	2×10×100
	2500 A	2×10×100



Circuit breaker and panel interlock:

Left interlock:

Upper interlocking rod (A): When it be pushed into 13±1 mm, the CB couldn't been closed

Lower interlocking rod (B): When CB is on closing position, the interlock extension elongation is about 33±2 mm

Right interlock:

Upper interlocking rod (C): When it be pull out 13±1 mm, the CB couldn't been closed

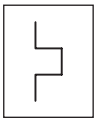
Lower interlocking rod (D): When CB is on closing position, the interlock extension elongation is about 33±2 mm

Note:

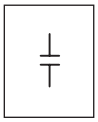
1. After the circuit breaker is pushed into the panel, it should be firmly fixed with the panel.
2. If the lap joint bus with circuit breaker length is greater than 50 cm, add the support for the bus bar.
3. The length of left and right chain rod can be specially customized according to user requirements.
4. Customers can select the left or right chain as required, or none at all.

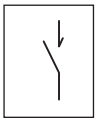
Electric circuit diagram

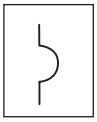
Graphical symbols for electrical diagrams (IEC 60617 Standards)

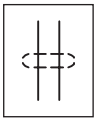

Thermal effect

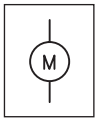

Mass, frame


Capacitor (general symbol)

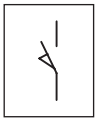

Passing make contact closing momentarily during release

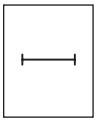

Electromagnetic effect

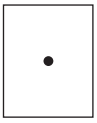

Conductors in shielded cable (two conductors shown)

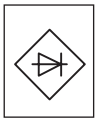


Motor (general symbol)

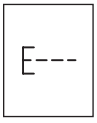

Closing position contact (limit switch)

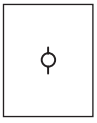

Timing

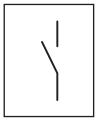

Connections of conductors

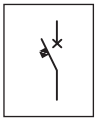

Rectifier with two half-waves (bridge)

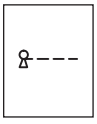

Opening position contact (limit switch)

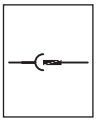

Pushbutton control

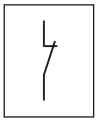

Terminal or clamp

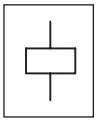

Make contact

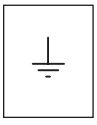

Power circuit breaker with automatic opening

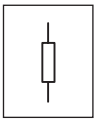

Operated by key

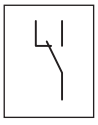

Socket and plug (female and male)

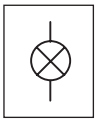

Break contact


Control coil (general symbol)

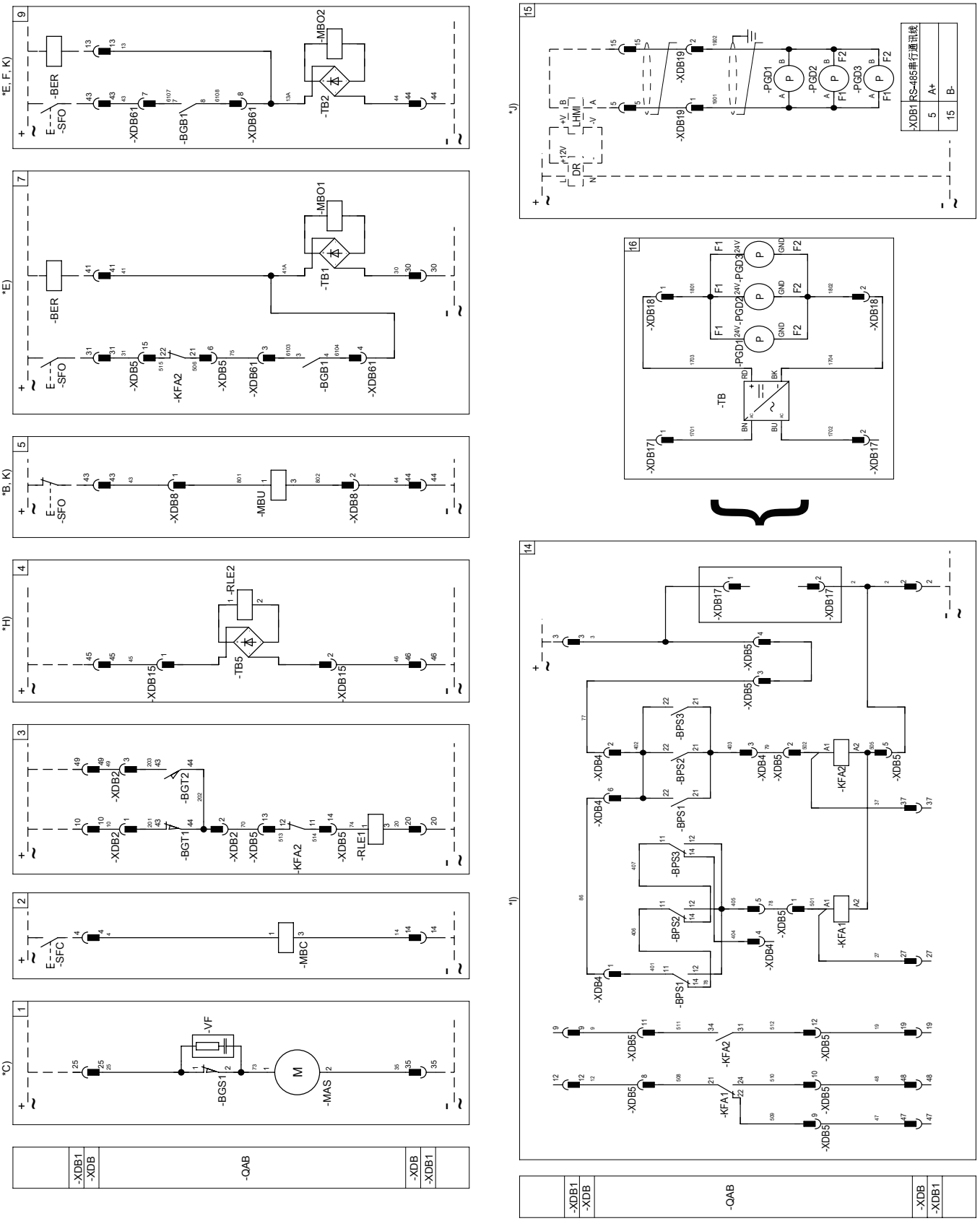

Earth (general symbol)

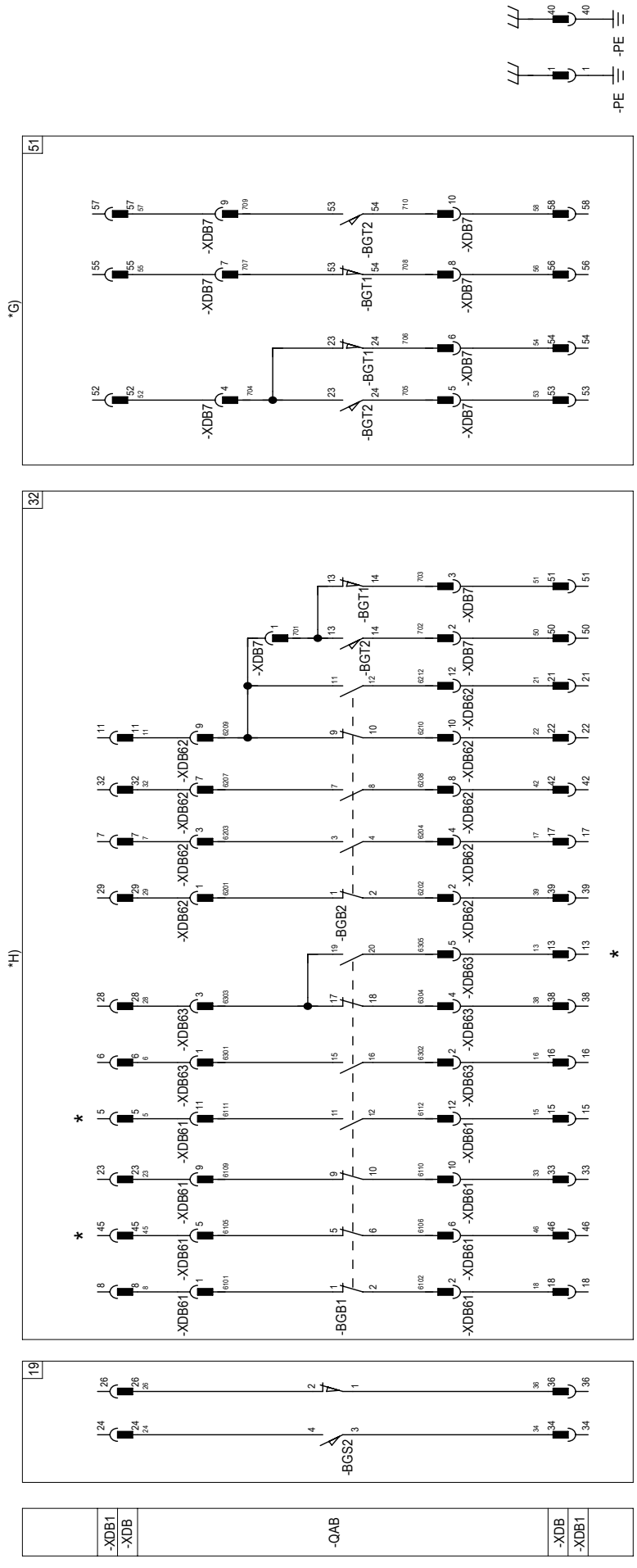

Resistor (general symbol)


Change-over break before make contact

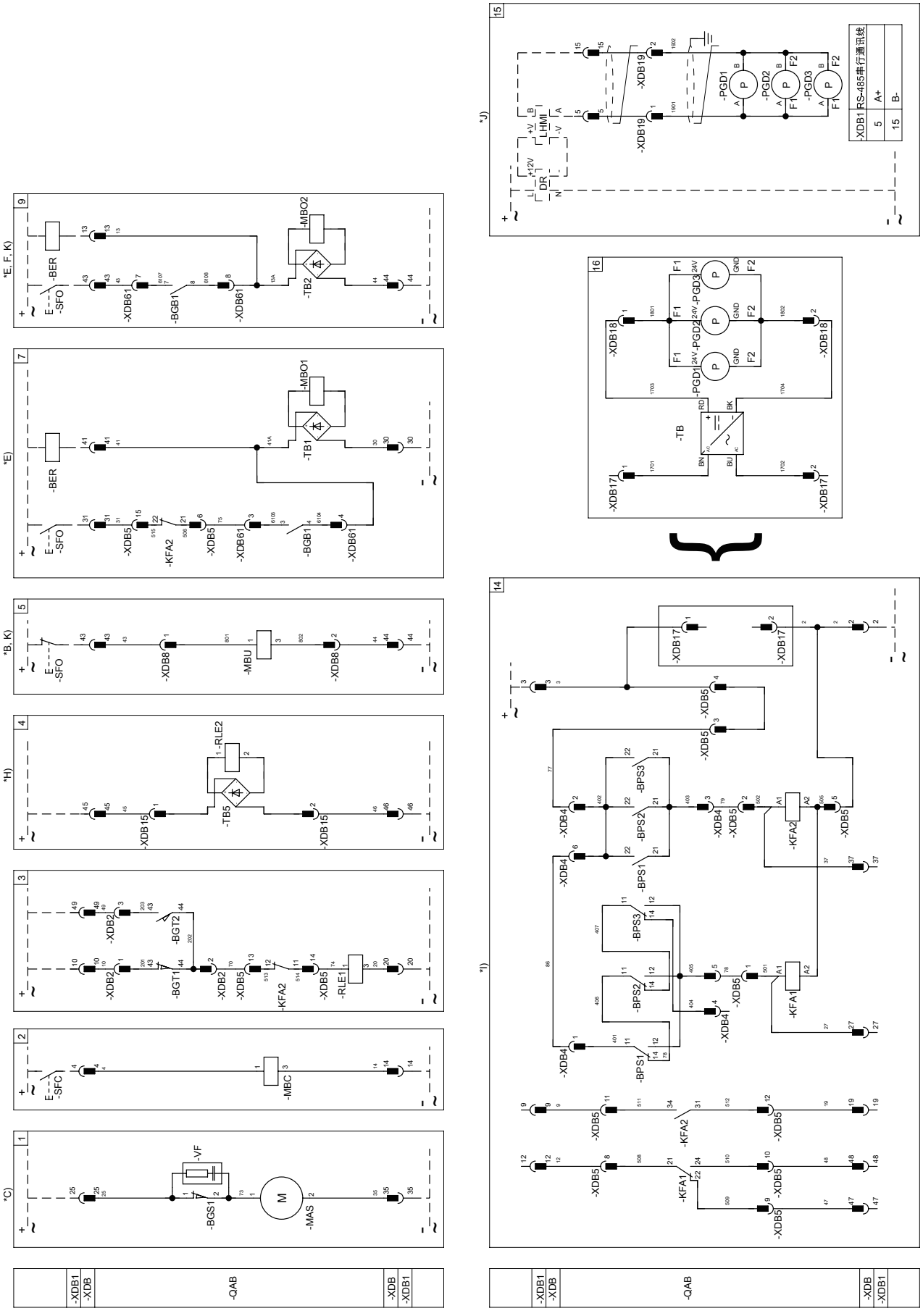

Lamp (general symbol)

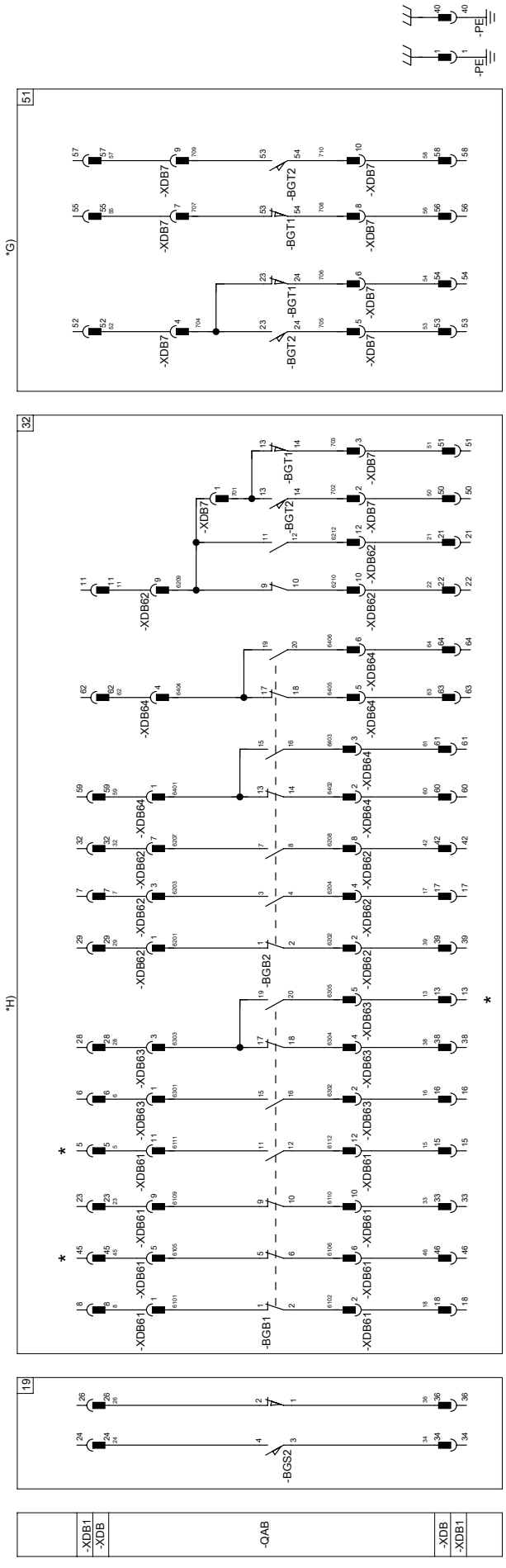
HD4/Z withdrawable ciircuit breaker electic circuit diagram (6NO6NC)




-XDB1
-XDB
-QAB
-XDB
-XDB1
19
-BGS2
32
*H)
-XDB61
-BGB1
-XDB62
-BGB2
-XDB63
-XDB7
-BGT1
-BGT2
51
*G)
-PE

HD4/Z withdrawable ciircuit breaker electic circuit diagram (8NO8NC)




-PE
-PE
51
*G)
-XDB7
-BGT2
-BGT1
32
*H)
-XDB62
-XDB64
-BGB2
-XDB63
-XDB61
-BGB1
19
-BGS2
-QAB
-XDB1
-XDB

State of operation shown

The diagram indicates the following conditions:

- Circuit breaker open and connected
- Circuits de-energized
- Closing springs discharged
- SF_6 gas pressure at rated service value (550kPa absolute at 20°C temperature).

The standard configuration

Fig. 1 -MAS Motor for the closing spring charging
Fig. 2 -MBC Shunt closing release
Fig. 3 -RLE1 Locking magnet
Fig. 7 -MBO1 First shunt opening release
Fig. 14 -BPS1...-BPS3 Pressure-switch
Fig. 19 -BGS2 Limit contacts of the spring charging motor
Fig. 32 -BGB1, -BGB2 Circuit-breaker auxiliary contacts
Fig.51 -BGT1,-BGT2 Contacts signalling CB in inserted & isolated position located on CB's truck.

Option auxiliary component

Fig. 4 -RLE2 Locking magnet (in truck)
Fig. 5 -MBU Undervoltage release
Fig. 9 -MBO2 Second shunt opening release
Fig.15 -PGD1...-PGD3 RS-485 for gas pressure digital display meter
Fig. 16 -PGD1...-PGD3 Gas pressure digital display meter

Caption

□ = Number of diagram figure
* = See note indicated by the letter
-BER = Device for continuous control of shunt open release coil continuity (see note E)
-KFA1 = Auxiliary relay to doulbe the -BP pressure-switch contacts with intervention for low gas pressure.
-KFA2 = Auxiliary relay to doulbe the -BP pressure-switch contacts with intervention for insufficient gas pressure
-SFC = Pushbutton or contact for circuit-breaker closing
-SFO = Pushbutton or contact for circuit-breaker opening
-BGB1-BGB2 = Circuit-breaker auxiliary contacts
-BPS1...BPS3 = Pressure-switch with two intervention thresholds:
– intervention for low gas pressure. Contact 11-12-14 changes over, in relation to the position indicated in the diagram, when the gas pressure reachs a value of less than 480 kPa absolute from 550 kPa. When the gas pressure retun to 550 kPa absolute from 480 kPa, the contacts change over to the original position.
– intervention for insufficient gas pressure. Contact 21-22-24 changes over in relation to the position indicated in the diagram, when the gas pressure reachs a value ofless than 450 kPa absolute from 550 kPa. When the gas pressure retun to 480 kPa absolute from 450 kPa, the contacts change over to the original position.
-TB1,TB2 = Rectifiers for -MBO1 and -MBO2 releases
-TB5 = Rectifiers for RLE2 locking electromamagnet
-MAS = Motor for loading closing springs (see note C)
-MBC = Shunt closing release
-MBO1 = First shunt opening release (see note E)
-MBO2 = Second shunt opening release (see note E)
-MBU = Instantaneous undervoltage release or undervoltage release with electronic time-delay de-vice (see note B)
-QAB = Main circuit-breaker
-BGS1 = Limit contacts of the spring charging motor
-BGS2 = Contact for signalling closing springs loaded-discharged
-BGT1 = Contacts electrically signalling circuit breaker in the connected position (see note G)
-BGT2 = Contacts electrically signalling circuit breaker in the isolated position (see note G)
-VF = Filter (only provided with 220V d.c. voltage supply)
-RLE1 = Locking magnet. If de-energized it mechanically prevents circuit breaker closing
-RLE2 = Locking magnet. If de-energized it mechanically prevents circuit breaker racking-in and isolation (it is possible to limit its consumption by connecting a delayed pushbutton in series to enable the operation)
-XDB = Circuit breaker circuit connector
-XDB1 = Switchgear terminal board (outside the circuit breaker)
-XDB2...-XDB64 = Accessory connectors
-PGD1...-PGD3 = RS-485 for gas pressure digital display meter.
-PGD1...-PGD3 = Gas pressure digital display meter.
-TB = Power adapter for gas pressure digital display meter
-DR = Power adapter for LHMI
-LHMI = Man-machine interface display (Mounting on low voltage chamber panel)

Description of figures

Fig. 1 = Closing spring charging motor circuit (see note C).
Fig. 2 = Shunt closing release (antipumping is carried out mechanically).
Fig. 3 = Locking magnet on operating mechanism. If energized, mechanically prevents circuit breaker from closing. Exclusion from permanent service of the magnet that provides a locking action upon circuit breaker closing is only per mitted with a delay of at least 0.5 s.
Fig. 4 = Locking magnet. If de-energized it mechanically prevents circuit breaker racking in and isolation (it is possible to limit its consumption by connecting a time-delay pushbutton in series for en abling the operation) (see note H).
Fig. 5 = Undervoltage release (see note B)
Fig. 7 = First shunt opening release circuit with possibility of continuous control of the winding (see note E).
Fig. 9 = Second shunt opening release circuit with possibility of continuous control of the winding (see note E and F).
Fig. 14 = Gas pressure control circuit. It includes (see note I):
1) intervention for insufficient gas pressure with lock on CB closing and opening by means of the KFA2 relay auxiliary contacts(provide the locking magnet in fig.3)
2) 3 lamps for local indication of normal, low and insuficient gas pressure
3) contacts for remote indication of normal, low and insufficient gas pressure
Fig. 15 = Gas pressure digital display meter with RS-485 (see note J)
Fig.16 = Gas pressure digital display meter
Fig.19 = Contact signalling charged or dis charged closing springs
Fig.32 = CB available auxiliary contacts
Fig.51 = Contact signalling CB in inserted and iso lated position located on CB truck (see note G)

Notes

A) The circuit breaker is only fitted with the accessories listed in the order confirmation. To make out the order, please consult the catalogue of the apparatus.

B) The undervoltage release can be provided for power supply with voltage branched on the supply side of the circuit breaker or from an independent source. Circuit-breaker closing is only possible with the release energised (the closing lock is made mechanically). A delay of 50 ms between the moment of consent of the undervoltage release and energisation of the shunt closing release must be inserted when there is the same power supply for the shunt closing and undervoltage releases and automatic circuit-breaker closing on return of the auxiliary power supply is required.

C) Check the power available on the auxiliary circuit to verify the possibility of starting several motors for charging the closing springs at the same time. To avoid excessive consumption, it is necessary to charge the springs manually before supplying the auxiliary circuit with voltage.

E) The circuit for controlling continuity of the shunt opening release winding must only be used for this function. At a power supply lower than 220 V, connect the “Control Coil Continuity” device, or a relay or a signalling lamp which consumes a current not exceeding 20 mA.

At a power supply equal to or higher than 220 V, connect a delay or signalling lamp which consumes a current not exceeding 10 mA.
Other uses might jeopardise release functional-ity.

F) Optional MO2, the auxiliary contact of KA2 needs to be extended outside the circuit breaker to lock the circuit, so as to ensure that the circuit breaker can not be opened when the SF_6 pressure is insufficient.

G) The contacts (-BT1 and -BT2) shown in fig. 51 for signalling the circuit breaker status are located on the circuit breaker (moving part) and are available on request. However, application of these contacts on the enclosure is usually foreseen (fixed part): see diagram 1VCD400036.

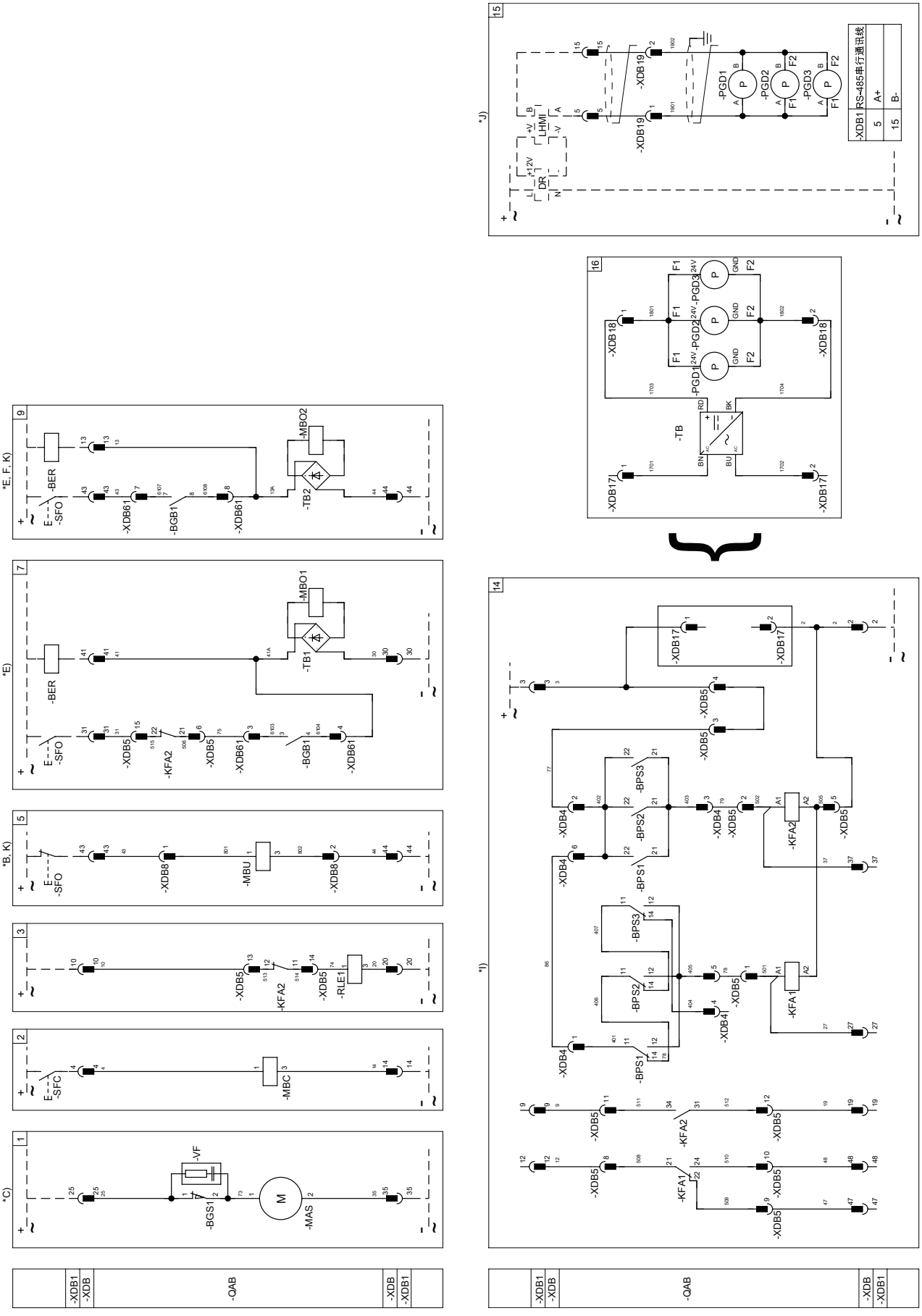
H) When fig. 4 is requested, the contacts of pack -BB1 to terminals 45-46 in fig.32 is not available. When figs.9 is requested, the contacts of pack -BB1 to terminals 13 in fig.32 is not available.

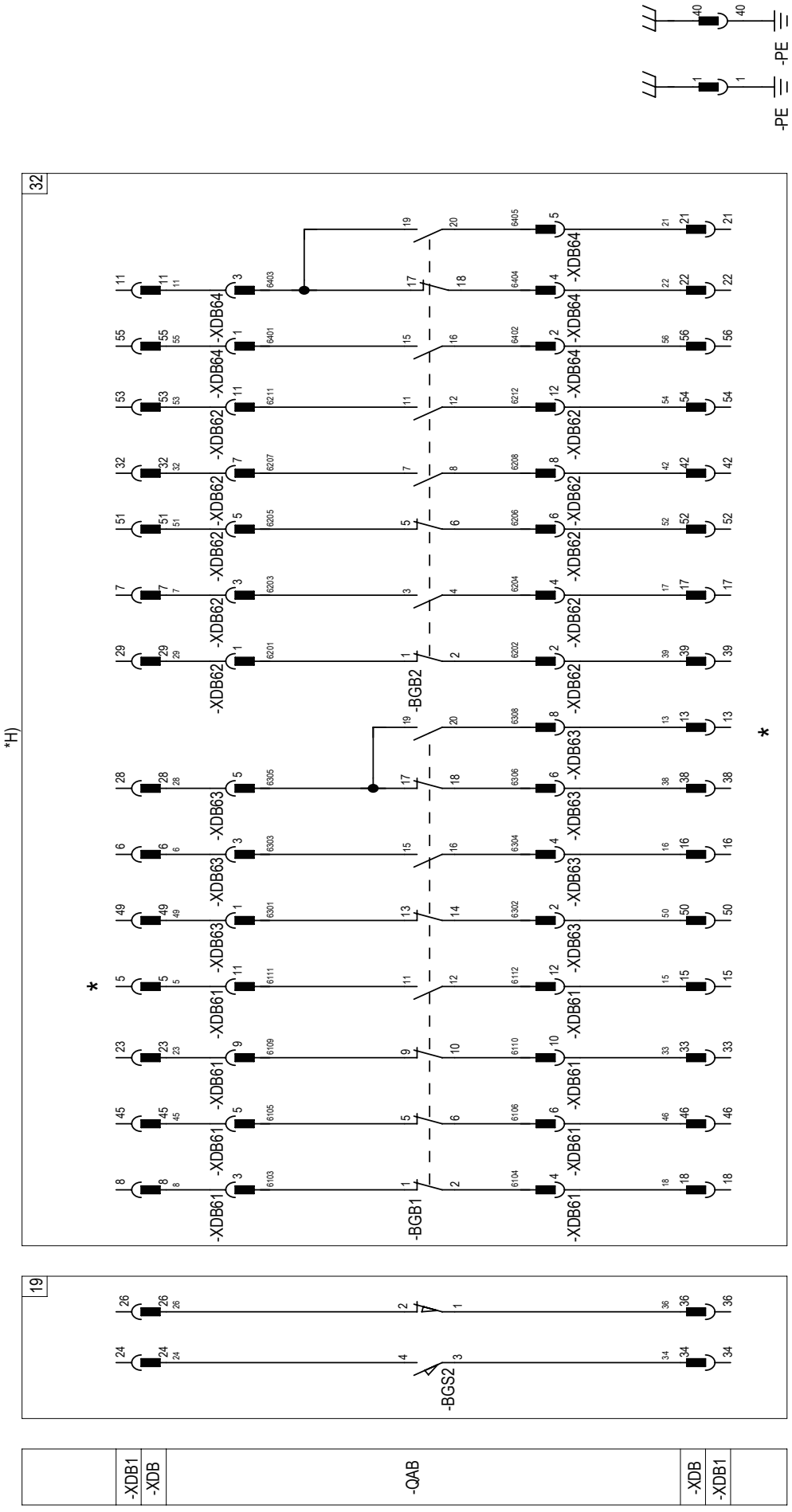
I) The terminals 27 and 37 in fig.14 only used for KA1 and KA2 functional test , should not be powered during normal operation. During the test, apply corresponding voltage between pins 2-27 and 2-37 respectively,If the relay has action, its function is normal, otherwise, its function is abnormal.

J) When RS-485 communicating connecting in parallel , pay attention to positive and negative polarities to prevent reverse connection or short connection and incorrect connection of external auxiliary power supplies. Shielded twisted pair cables are recommended for connection.

K) Please check with ABB when require fig.5 & fig.9.

HD4 Fixed ciircuit breaker electic circuit diagram




-PE
-PE
32
19
-XDB1
-XDB
-QAB
-XDB
-XDB1
-BGB1
-BGB2
-BGS2
*H)
*
*

State of operation shown

The diagram indicates the following conditions:

- Circuit breaker open and connected
- Circuits de-energized
- Closing springs discharged
- SF_6 gas pressure at rated service value (550kPa absolute at 20°C temperature).

The standard configuration

Fig. 1 -MAS Motor for the closing spring charging
Fig. 2 -MBC Shunt closing release
Fig. 3 -RLE1 Locking magnet
Fig. 7 -MBO1 First shunt opening release
Fig. 14 -BPS1...-BP3 Pressure-switch
Fig. 19 -BGS2 Limit contacts of the spring charging motor
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Option auxiliary component

Fig. 5 -MBU Undervoltage release
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